



U.S. Department of Energy
Energy Efficiency and Renewable Energy

Energy Savings Performance Contracting

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Technical and Financial Solutions for Improved Energy Efficiency

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Energy Performance Contracting

Definition:

- Performance contracting is a procurement mechanism that enables energy and operational savings to pay for part or all of the project with results that are guaranteed during the contract term.





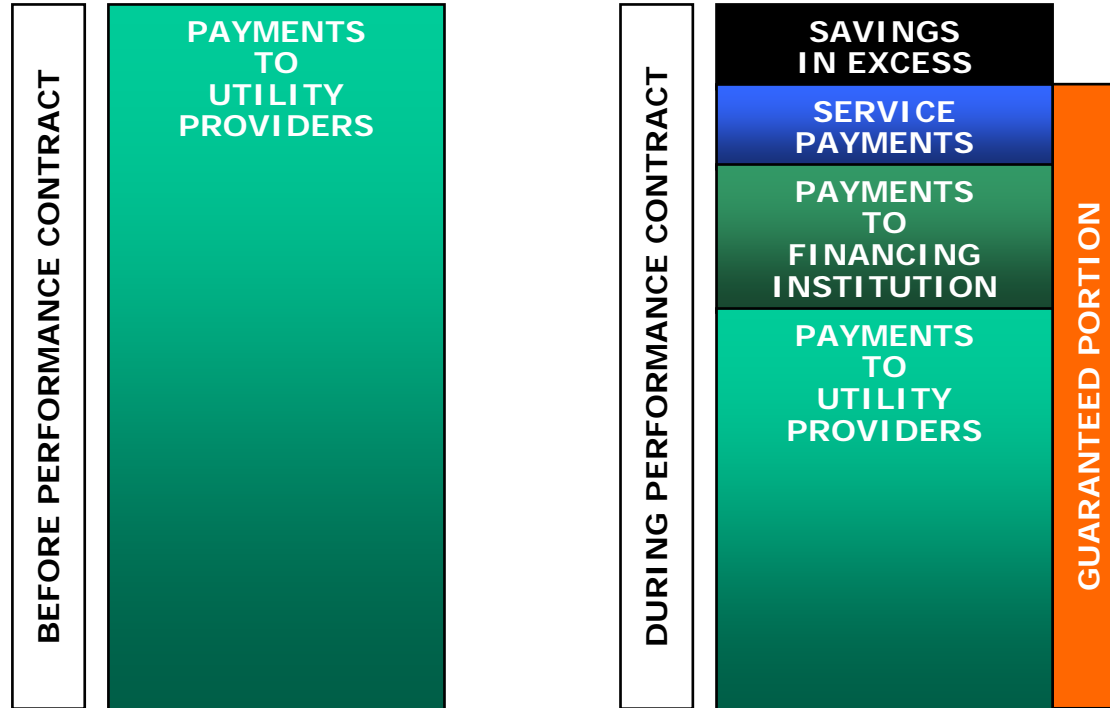
Energy Performance Contracting

Attributes:

- Outcome-based Guarantee
- A way to finance and implement capital improvements and services
- Should be offered by a qualified Energy Service Company (ESCO)
- Energy and cost savings need to be sufficient to cover all project costs
- A bundled set of retrofit, service, O&M, and Energy Management Services



Energy Performance Contracting





Objectives

- Understanding Energy Consumption - Baseline
- What are Energy Conservation Measures (ECM)
- Important Factors to Developing ECMs
- Bundling ECMs
- What does a PC pro forma look like?
- Other Economic Considerations
- Questions



Energy / Utilities

- Electricity
- Steam
- Fuels
 - Oil
 - Natural Gas
 - Liquid Propane
 - Coal
- Water
- Sewer
- Chemicals?

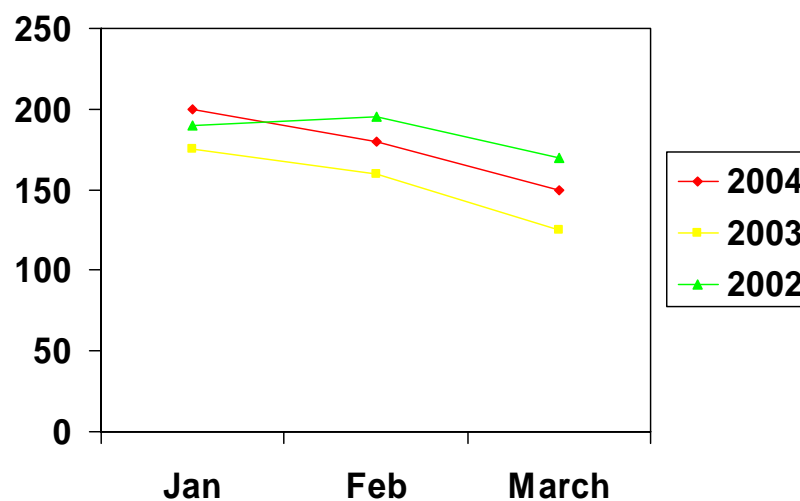
Operations

- Repair
- Scheduled Maintenance
- Outsourced Agreements
- Contractor Support
- Training and Tools
- Monitoring
- Work Order System



Energy Baseline

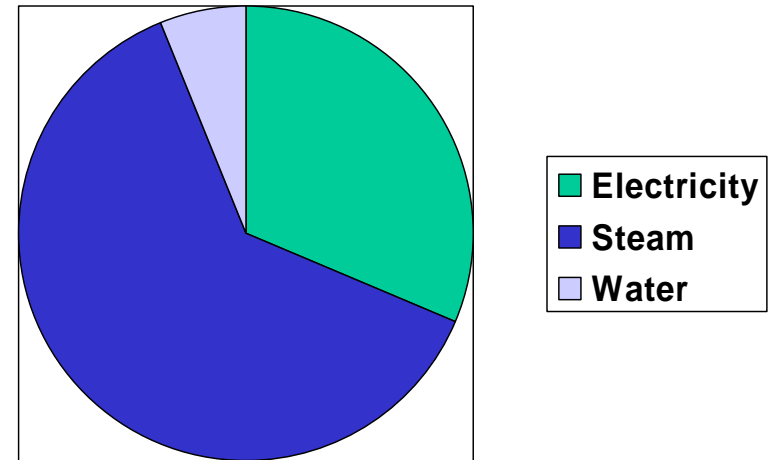
- Starting point from which savings are derived
- 1 to 3 blended calendar years of consumption
- Weather adjusted





Energy Baseline

- Total annual spend per utility
- Benchmark usage \$/sq.ft.





Energy Performance Contracting

ECM Considerations:

- What can be considered under Maine legislation?
- What are the "wish list" improvements?
- What are the biggest issues for facilities?
- What is the best case scenario for "after PC"?



Energy Intensive

- Energy Management Systems
- Efficient Lighting
- Energy efficient motors
- Variable frequency drives
- Vending machines, plug loads
- Steam traps
- Toilets, Faucets and Showers
- Kitchen appliances
- Renewable Energy Options;
PV, Wind, Fuel cell, Geo-
thermo
- Fuel switching options
- Cogeneration
- Green Buildings

Facility Intensive

- Central Plant upgrades
- Utility Distribution:
 - Steam
 - Water
 - Electrical
- Window replacements
- Roofs
- Major HVAC equipment replacement



Typical ECM Energy Components

	Electricity	Steam	Water
Lighting			
Steam Traps			
Drives			

- Interactivity is an important consideration
- Computer Modeling is often preformed (DOE programs)



Typical Energy Conservation Measures

- Lighting comprises more than lamp and ballast retrofits



Strategy	Relative Range of Savings	Factors
Load Management	20-50%	Depending on utility rate schedule
Daylight Harvesting	40-60%	Average over entire year for only that area with access to natural lighting
Occupancy Recognition	10-50%	Depending on space type and usage
Scheduling	10-40%	Depending on occupancy pattern
On/Off	10-50%	Compared to no switching
Task Dimming	10-50%	Depending on Occupancy preference
Adaptation Compensation	10-40%	Depending on facilities nighttime lighting requirements
Lumen maintenance	10-20%	Depending on lamp lumen depreciation
T8/T5 lamps & Electronic Ballasts	20-50%	Depending on existing system configuration
LED exit signs	80-90%	Depending on existing system configuration



Typical Energy Conservation Measures

- HVAC Retrofits provide energy savings and address deferred maintenance



Strategy	Relative Range of Savings	Factors
High Eff. Chiller	20-30%	Existing age and configuration
High Eff. Boilers	10-20%	Existing age and configuration
Variable Frequency Drives	5-15%	Load diversity and zone configuration
High Eff. motors	3-5%	Depending on age and loading



Typical Energy Conservation Measures

- Building Automation System ties it all together

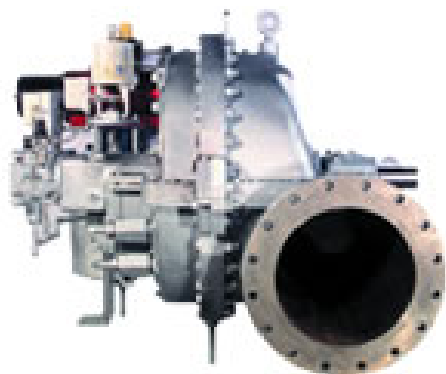


Strategy	Relative Range of Savings	Factors
Setpoint Accuracy	2-5%	Existing system and temperature range requirement
Self Tuning Control Loops	1-3%	Varies with load and rate of change of load
Chiller/Boiler Plant Optimization	3-5%	Varies with load and rate of change of load
Scheduling Optimization	1-2%	Depends on diversity of operations and zone configuration
VAV box optimization	10-50%	Depends on existing setpoint and system configuration
Demand Limiting	3-5%	Depending on utility rate schedule
Equipment Interlock	1-3%	Depends on diversity of operations and zone configuration
Trend logs/Predictive sensing	5-10%	System knowledge required of operators to fully utilize data
Consistent Facility Operations	4-7%	Primarily for multiple managed facilities



Typical Energy Conservation Measures

- Cogeneration can provide dramatic savings due to a lower cost to generate electricity combined with heat



- Gas Fired Turbines
- Reciprocating Engine
- Steam Turbine
- Fuel Cells
- Micro Turbines



Typical Energy Conservation Measures

- Sustainability provides long term economic and environmental benefits



Level 1 Level 2 Level 3 Level 4 Level 5



- Retro-commissioning
- Energy Star
- Cleaner and Greener
- LEED for existing buildings



Building a Feasible Project

Bundle multiple ECMs to achieve a desired financial outcome

Example: (actual payback periods are project dependent)

ID	ECM	Payback	ID	ECM	Payback
1	Lighting System Upgrades	5.1	15	Vending Machine Upgrades	3.8
2	Chiller Replacements - Absorber	83.5	16	Electric Car Charging	0.4
3	Cooling Tower Replacement	212.0	17	Pool Covers	7.1
4	AHU Conversions	17.7	18	High Efficiency Motors	7.3
5	Electric to Gas Conversion	10.9	19	High Efficiency Transformers	6.9
6	Water Conservation	5.9	20	Back Pressure Steam Cogenerator	4.5
7	Variable Airflow Conversions	43.5	21	Hockey Rink Low-E Ceiling	8.2
8	Building Automation	2.7	22	Ground Source Heat Pump	102.6
9	Steam Trap Replacement	6.4	23	Photovoltaic Modules	41.6
10	Thermostatic Radiation Valves	6.5	24	Insulate Attics	6.07
11	Pipe Insulation	2.34	25	Utility Metering	-
12	Steam Pipe Replacement	5.2	26	Retrocommissioning	-
13	Condensate Equipment Repairs	2.7		Consolidated Simple Payback (yrs.)	6.25
14	Fume Hood Occupancy Control	6.6			



Energy Performance Contracting

- Financial Criteria
 - Discounted Cash Flows
 - Discount Factors
 - What is the 'right' factor
 - How do you adjust for RISK



Energy Performance Contracting

- Leasing Options
 - Who has the Lowest Rate
 - Existing Credit Lines
 - Local Banks
 - National Banks
 - Construction Period
 - Savings
 - Interest



Energy Performance Contracting

Example Business Case:

Year	Annual State Aid	Annual Energy Savings	Annual Operational Savings	Energy Rebate/ Incentives	Capital Cost Avoidance	Total Annual Savings	Annual Project Costs	Annual	Annual Service Costs	Total Costs	Annual Cash Flow	Cumulative Cash Flow
Installation	0%	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
1	\$ -	\$2,110,508	\$0	\$500,000	\$0	\$ 2,610,508	\$1,592,756	\$100,000	\$100,000	\$1,692,756	\$917,752	\$917,752
2	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$102,500	\$102,500	\$1,695,256	\$415,252	\$1,333,004
3	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$105,063	\$105,063	\$1,697,818	\$412,690	\$1,745,694
4	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$107,689	\$107,689	\$1,700,445	\$410,063	\$2,155,757
5	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$110,381	\$110,381	\$1,703,137	\$407,371	\$2,563,128
6	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$113,141	\$113,141	\$1,705,897	\$404,611	\$2,967,739
7	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$115,969	\$115,969	\$1,708,725	\$401,783	\$3,369,522
8	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$118,869	\$118,869	\$1,711,624	\$398,884	\$3,768,406
9	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$121,840	\$121,840	\$1,714,596	\$395,912	\$4,164,318
10	\$ -	\$2,110,508	\$0	\$0	\$0	\$ 2,110,508	\$1,592,756	\$124,886	\$124,886	\$1,717,642	\$392,866	\$4,557,184
Totals	\$0	\$21,105,079	\$0	\$500,000	\$0	\$21,605,079	\$15,927,557	\$1,120,338	\$1,120,338	\$17,047,895	\$4,557,184	\$4,557,184



Energy Performance Contracting

Typical Finance Variables:

Energy Savings	\$2,110,508	Project Cost	\$12,561,079
Operational Savings	\$0	Down Payment	\$0
Total	\$2,110,508	Installation Term (Months)	12
Energy Rebate/ Incentives	\$500,000	Interim Period Income Rate	0.000%
		Approx. Interim Finance Cost	\$513,329
Simple Payback	5.71	Project Cost	\$12,561,079
Net Present Value (NPV)	\$186,328		
Internal Rate of Return (IRR)	10.36%	Down Payment	\$0
Capital Cost Allowance Percentage	5.0%	Total Cost to Finance	\$13,074,408
Depreciable Equipment Cost	\$0		
Depreciable Equipment Life (Years)	30		
Tax Rate	0%		
Discount Rate (Hurdle Rate)	10.00%		
Term of Financing (Years)	10.00		
Rate of Financing	4.000%		
Cash Flow Term (Years)	10		
Arrears Payment (Y/N)	Y		
Payment Term (M, Q, S, A)	Q		
Include Capital Avoided Cost in CashFlow?	N		
State Aid Reimbursement Rate	0.0%		



Thank You